Introducing the CT GIS Office and New Imagery Services

Alfredo Herrera, GIO, CT GIS Office
Carl Zimmerman, PhD, CT GIS Office
Emily Wilson, UCONN CLEAR, Geospatial Educator
Sept 12, 2024
Presented as a webinar in collaboration with UCONN CLEAR

Data & Policy Analytics

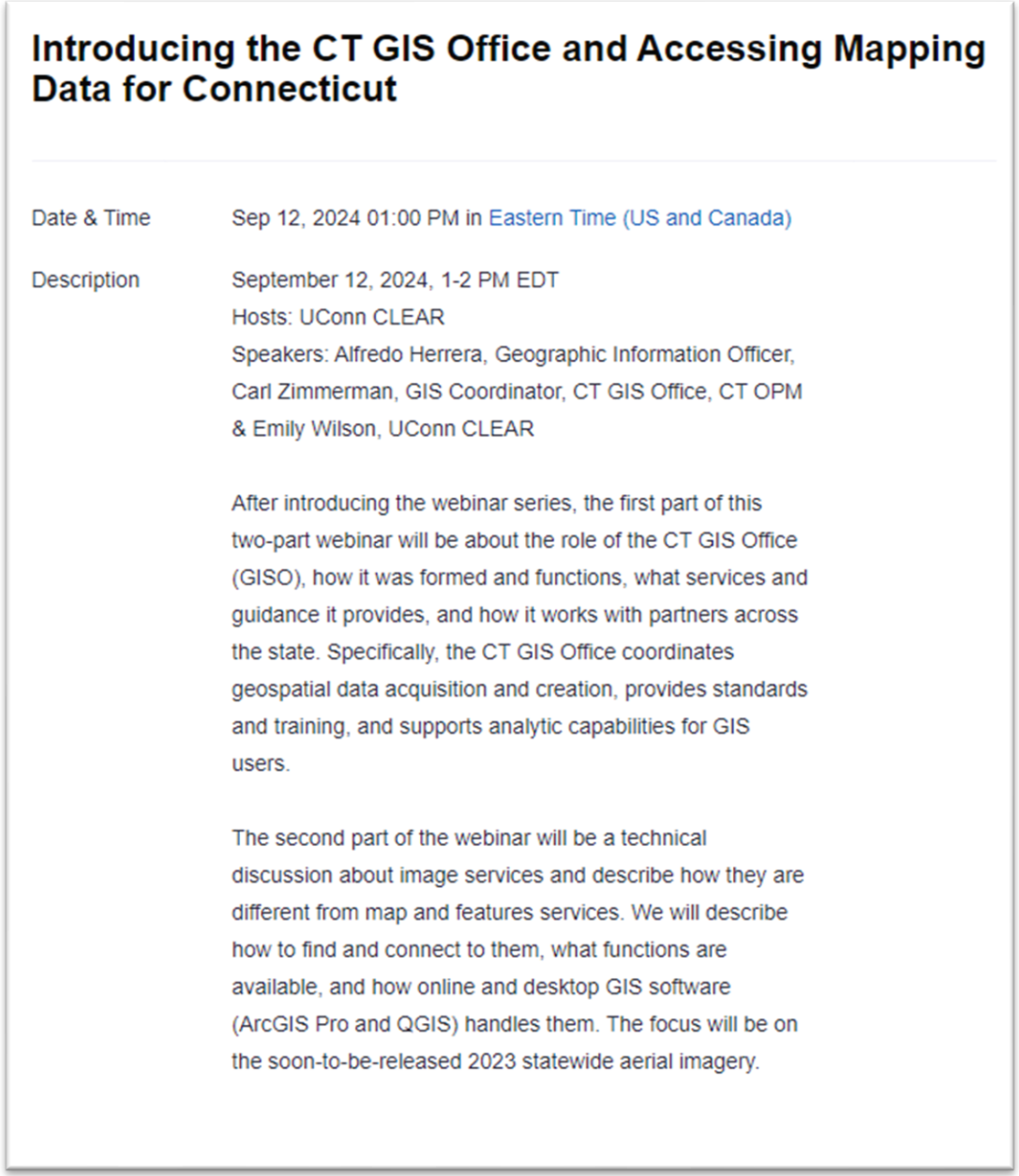
Connecticut GIS Office

CONNECTICUT Policy and Management

Overview

2 parts

- Introducing the CT GIS Office
- All about Imagery Services
  - What are web services?
  - Finding imagery and using it
  - Available tools



Introducing the CT GIS Office and Accessing Mapping Data for Connecticut

Date & Time	Sep 12, 2024 01:00 PM in Eastern Time (US and Canada)
Description	September 12, 2024, 1-2 PM EDT Hosts: UConn CLEAR Speakers: Alfredo Herrera, Geographic Information Officer, Carl Zimmerman, GIS Coordinator, CT GIS Office, CT OPM & Emily Wilson, UConn CLEAR After introducing the webinar series, the first part of this two-part webinar will be about the role of the CT GIS Office (GISO), how it was formed and functions, what services and guidance it provides, and how it works with partners across the state. Specifically, the CT GIS Office coordinates geospatial data acquisition and creation, provides standards and training, and supports analytic capabilities for GIS users. The second part of the webinar will be a technical discussion about image services and describe how they are different from map and features services. We will describe how to find and connect to them, what functions are available, and how online and desktop GIS software (ArcGIS Pro and QGIS) handles them. The focus will be on the soon-to-be-released 2023 statewide aerial imagery.

GIS Office & Geographic Information Officer (GIO)

OPM's Geographic Information Systems (GIS) Office was established in 2022 following passage of Public Act 21-2 during the 2021 June Special Session.

It is directed by a Geographic Information Officer (GIO) and resides within the Data and Policy Analytics Unit of OPM.

GIS Office Responsibilities

CGS Sec. 4d-90-92, 16-330b (Broadband)

- **GIS data coordination.** Coordinating the collection, compilation and dissemination of GIS data across the state, including from and to state agencies, regional councils of governments, municipalities and other constituencies;
- **Open data.** Managing a publicly accessible geospatial data clearinghouse;
- **Supporting economic development.** Using GIS to support economic development efforts in the state;
- **Outreach & training.** Provide training and outreach on the use of GIS;
- **Orthoimagery.** Administering a statewide orthoimagery and lidar program;
- **Guidance & Standards.** Adopting geospatial data standards, guidelines, and procedures;
- **Data processing.** Performing technical data processing to aggregate and organize existing datasets and create new datasets; and
- **Broadband mapping.** Develop broadband data and mapping in accordance with Public Act 21-159.

GIS Office Staff

CT GIS Office

Alfredo Herrera – Geographic Information Officer

Carl Zimmerman – GIS Coordinator

Ashley Benitez – GIS Coordinator

Leah Hodges – GIS Analyst

Sarah Hurley – GIS Analyst

Data Opportunities

CT Geodata Portal
About
Data Library
Partners
CT Geodata Portal
Search or browse GIS data for Connecticut
New & Noteworthy | CT at a Glance | Data Categories | Partners

Data & Policy Analytics

Geodata Portal Highlights

https://geodata.ct.gov

ArcGIS Hub based GIS Clearinghouse built in collaboration with Esri.

The Geodata Portal shares partner agency data to make it available all in one place.

The site has been live for almost 2 years! Updates occur regularly.

Coordinating with state agencies to regularly add new data.

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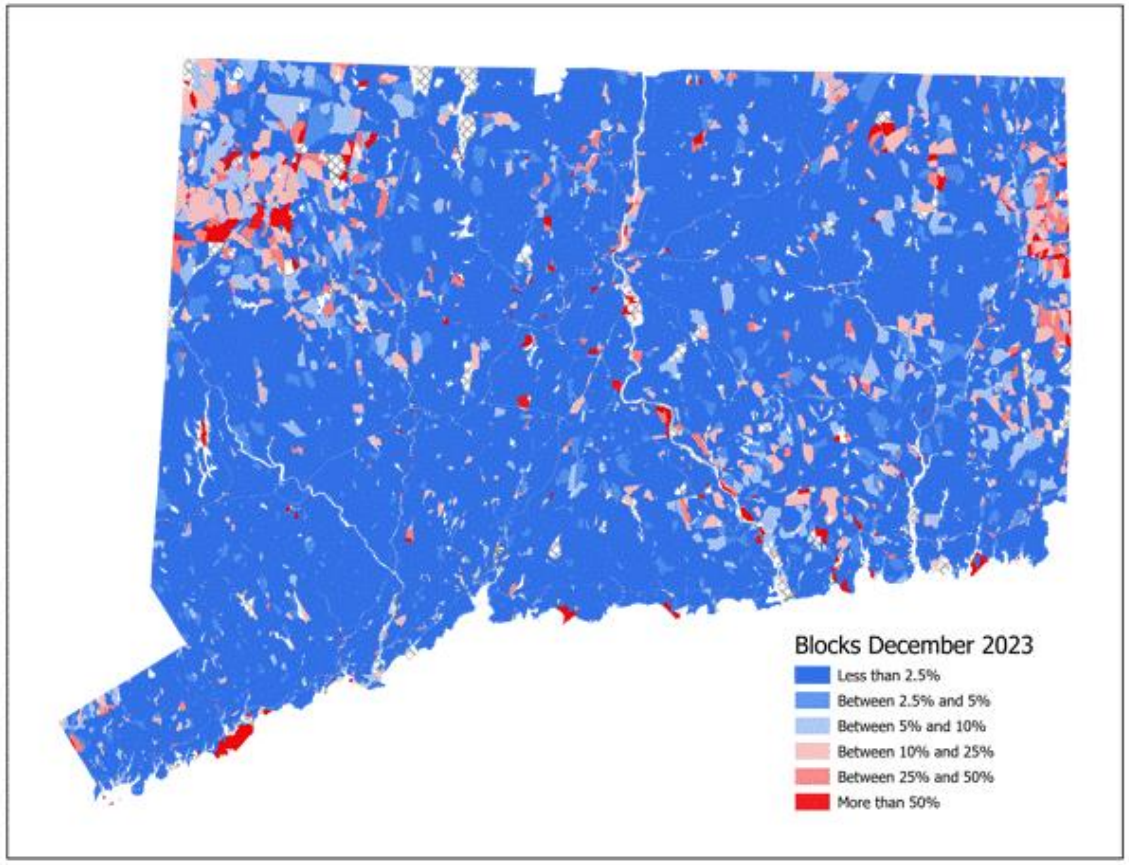
Broadband Mapping

Visit broadbandmaps.ct.gov for more!

- Fifth data collection from ISPs underway to provide a timely and granular look at the state of broadband in CT.
- New public maps by Dec 1.



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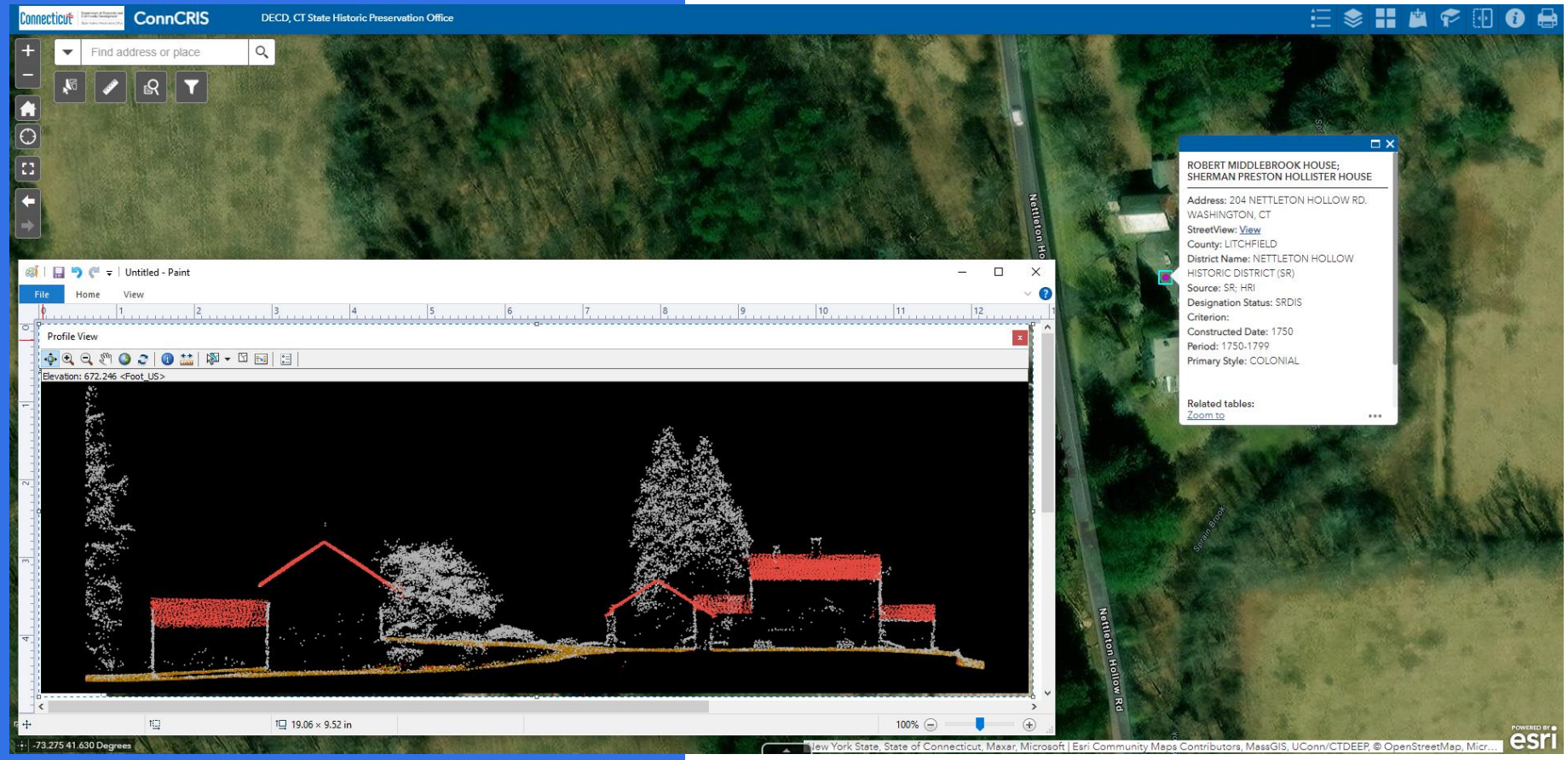
ConnCRIS Application

- CT SHPO Launched the ConnCRIS Public Viewer.
  - Displays only above-ground cultural resources.
- New secure viewer available now!
  - Request access with SHPO.



Visit conncris.ct.gov for more!

Data & Policy Analytics

Statewide Parcels

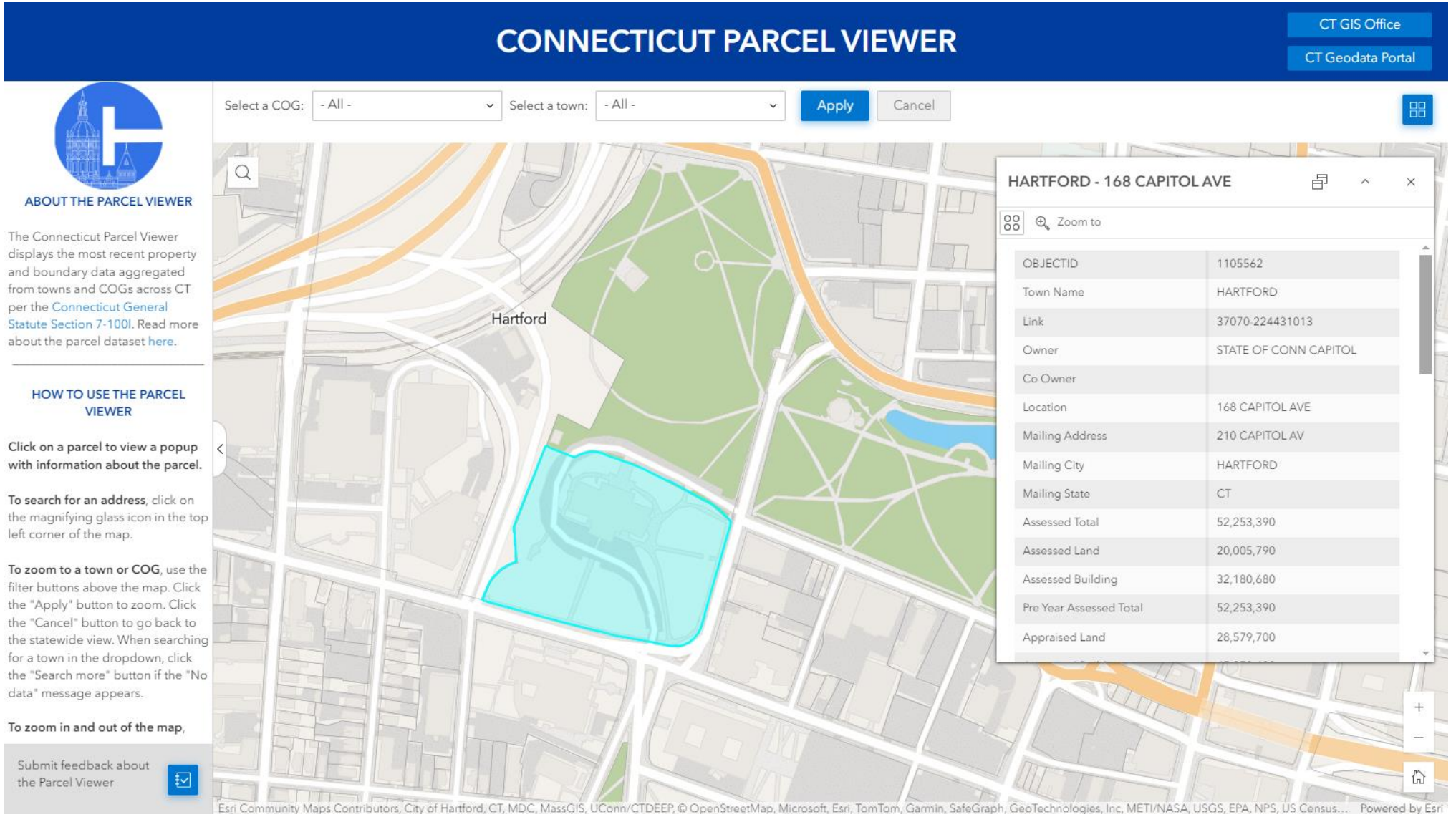
Seamless Statewide Dataset

Full attribution from assessors' databases

2024 update underway, new dataset expected this fall

https://geodata.ct.gov/pages/parcels

Statewide Parcel Viewer



Statewide Addressing

GIS Office partnering with DESPP/DSET to further improve the Address Point dataset.

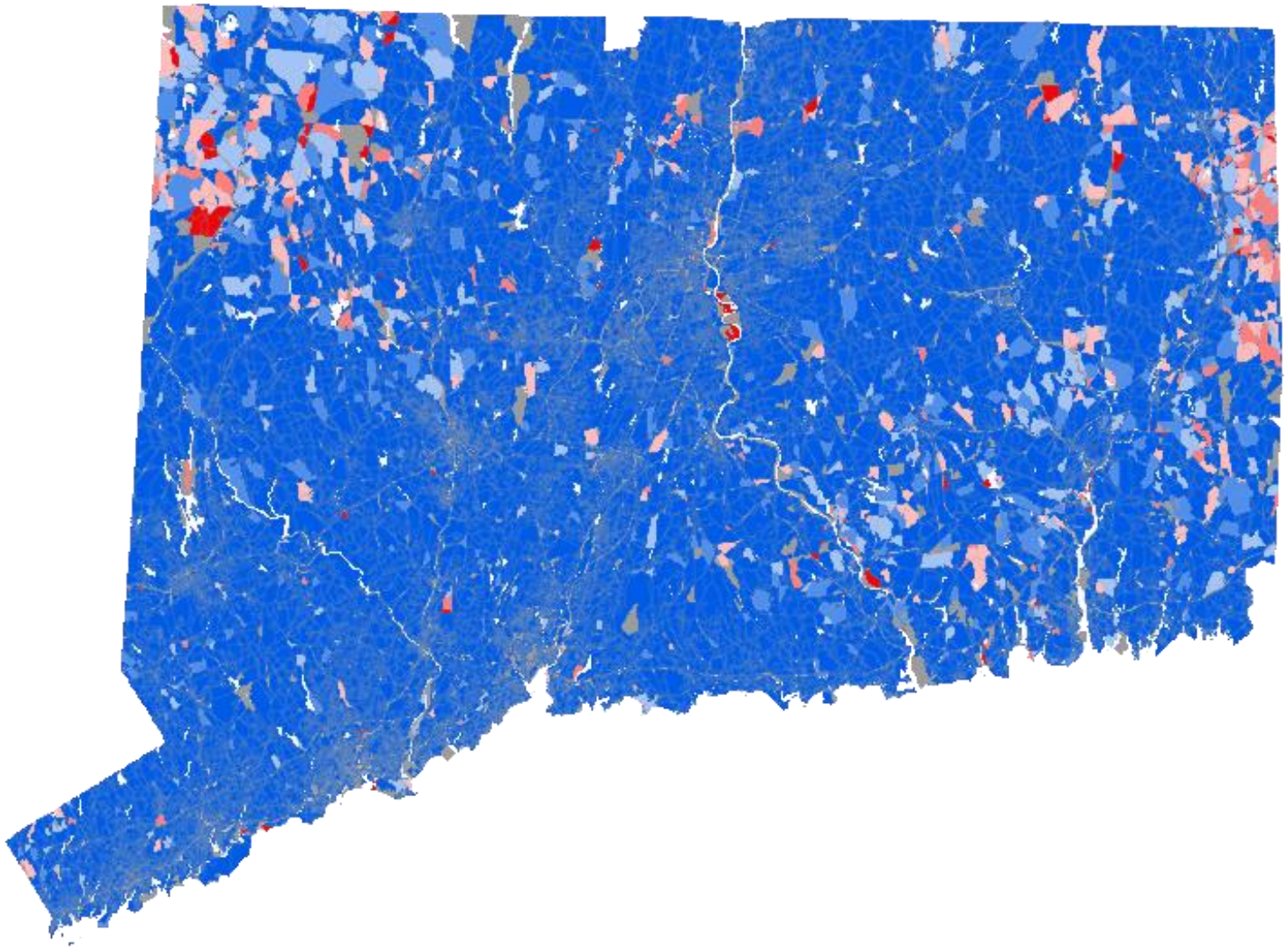
Currently aggregating data from utilities, ISPs, and other available sources to fill gaps in current dataset.

- DSET data has 1.1M addresses, GISO data has 1.5M addresses, and we estimate ~1.8M total addresses in CT.

Developing a plan to more easily collect address data from local authorities.

Collaborating with DSET and DOT to create a more accurate and publicly sharable centerline layer.

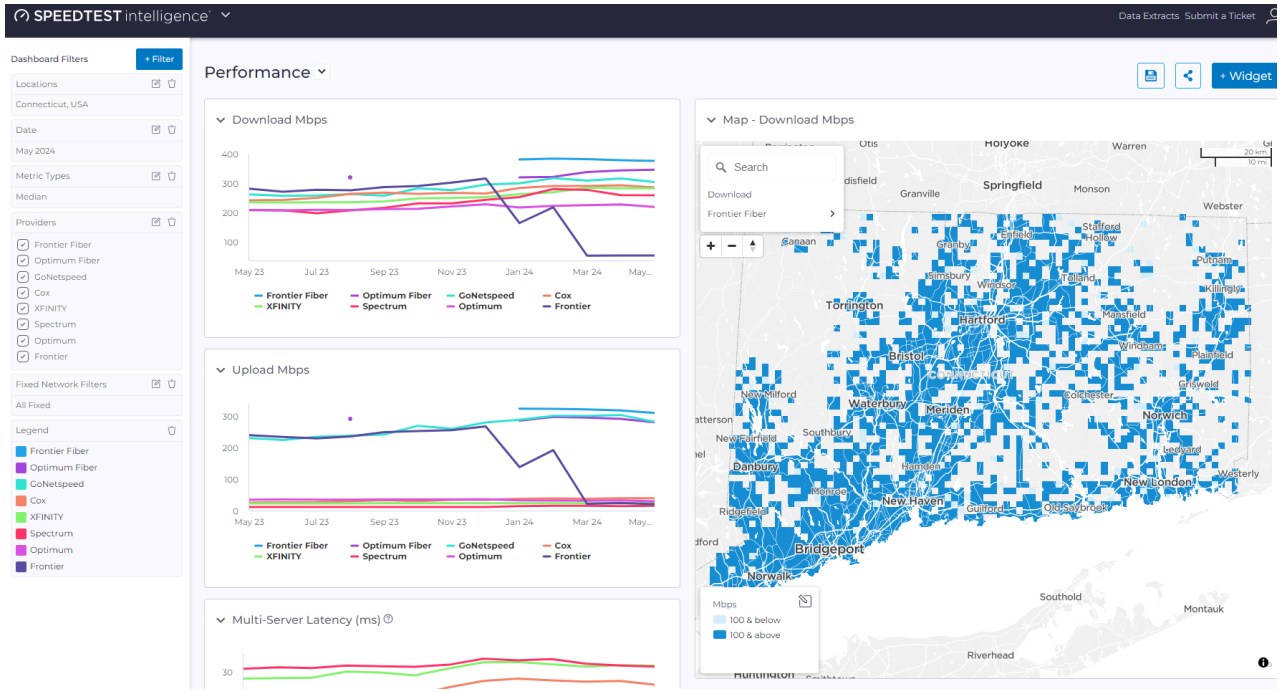
Broadband Activities



https://broadbandmaps.ct.gov/

Data & Policy Analytics

Broadband



2024 CT's Broadband Data Collection – Starting Soon

>ISPs have been contacted to reestablish the data collection process.
>We are targeting simplified schemas that better align with FCC BDC Submissions.

Ookla Speedtest Intelligence (STI) Portal and Data Extracts

Includes:
> Tests at 100x100 meter bins
> Performance data, including Download, Upload, Latency, Consistency Score™, and Speed Score™.

ArcGIS Living Atlas Data

Federal Communications Commission Data - June 2023

Ookla Speedtest for Global Broadband Performance

Part 2: All about Imagery Services

What are web services?
Finding imagery and using it
Available tools

The Aerial Imagery Data Acquisition Program

Two imagery and LiDAR captures in Spring 2023 and Spring 2026.

Dewberry selected as the vendor, aerial acquisition complete, QAQC complete, data deliveries now beginning.

Products purchased for both captures.*

- **3" 4-band imagery** (True ortho over urban cores and tall bridges)
- **QL1HD LiDAR data** (20ppsm coastal, 15ppsm inland)
- **2-foot DEM**
- **1 ft. Contours**
- **Building Footprints** (>100 ft^2)
- **3D Terrain and (LoD2) Building Models**

* Additional dataset purchases in the exploratory phase.

Specifications for Imagery

ASPRS Specifications

- Authoritative geospatial standards

RGB

- 3-inch pixels
- Leaf-off, low-tide, snow free, >35 degrees sun angle, distortion and smudge free

Near IR

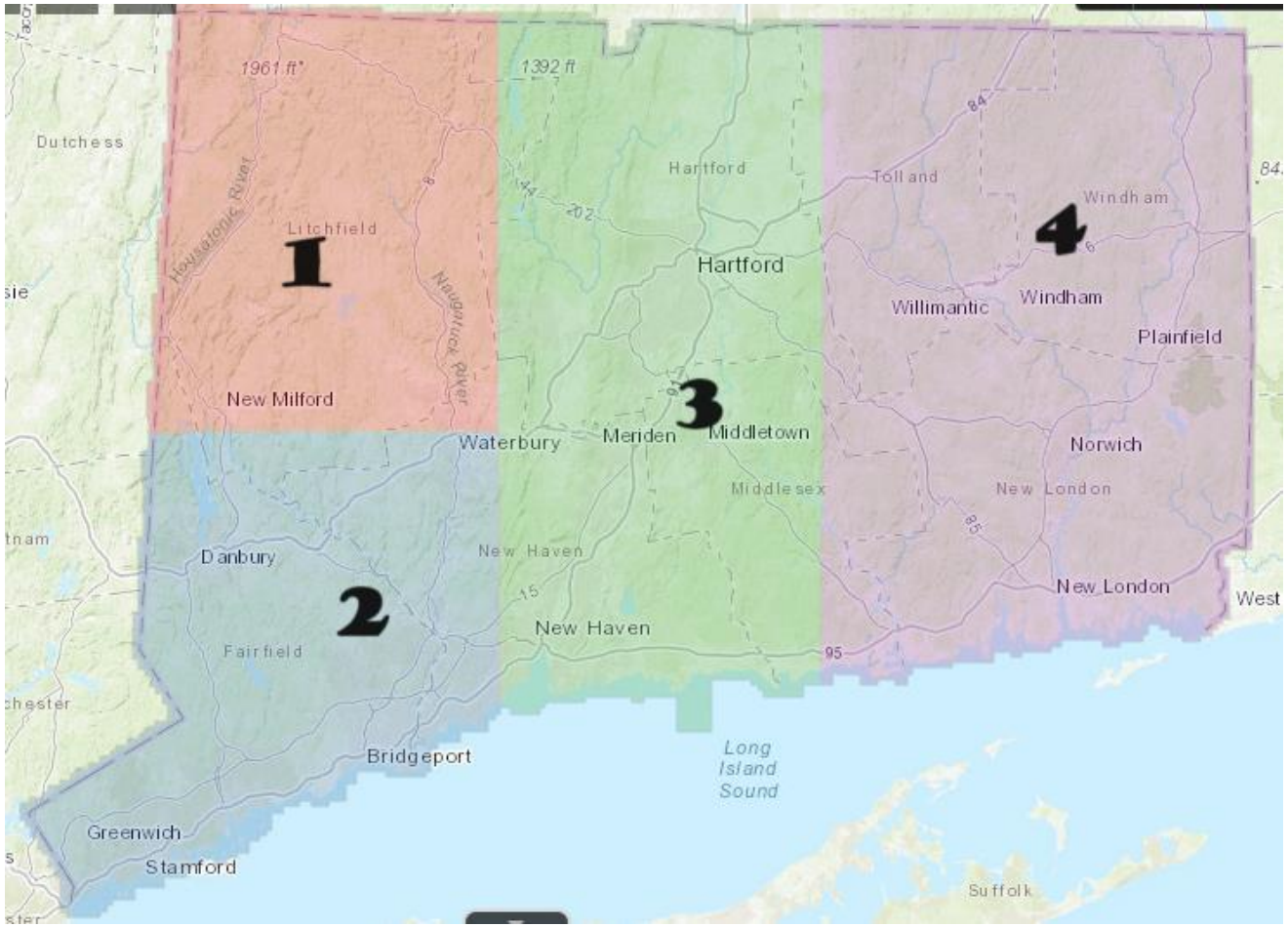
- Flown at same time
- Drop blue band and add invisible IR band through the red channel for visualization
- Useful for environmental applications and finding vegetation/h20

True Ortho

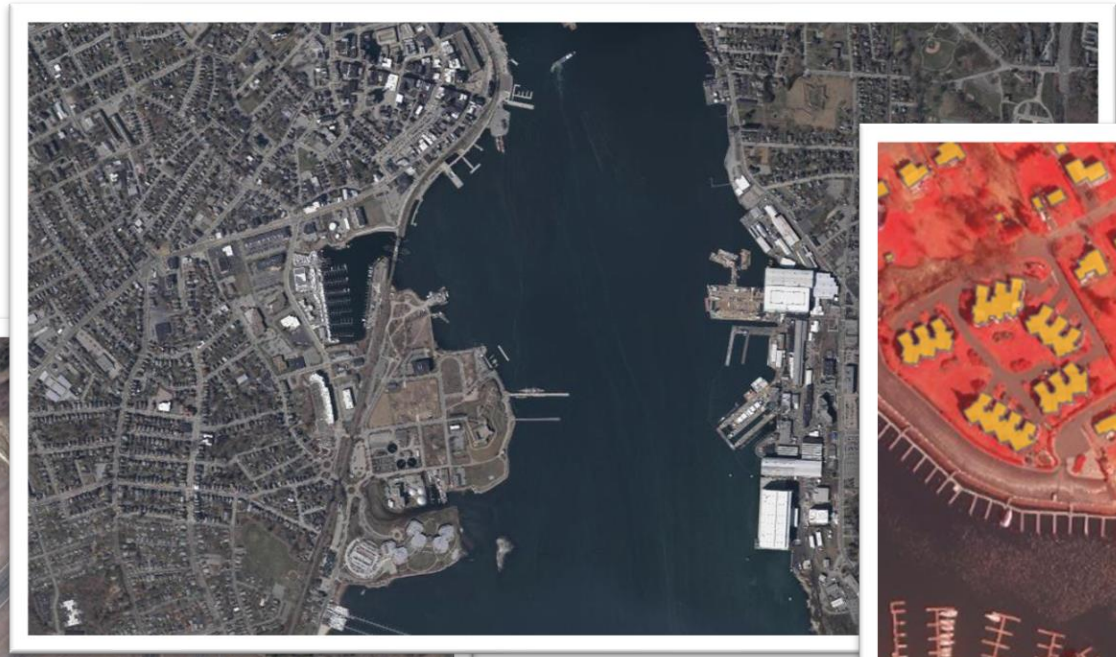
- Will be added to the imagery service

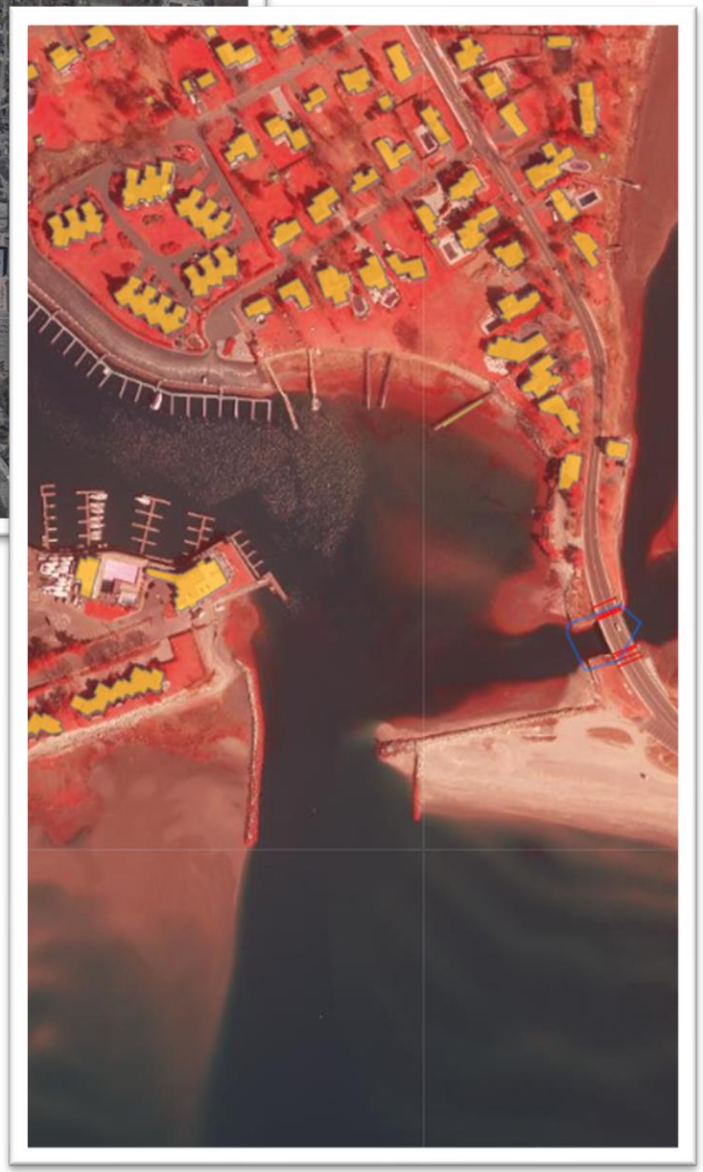
Delivery Blocks and Schedule

Strategically arranged to have least amount of work in Block 1 and most amount of processing in Block 3.



We have Imagery!





True Ortho

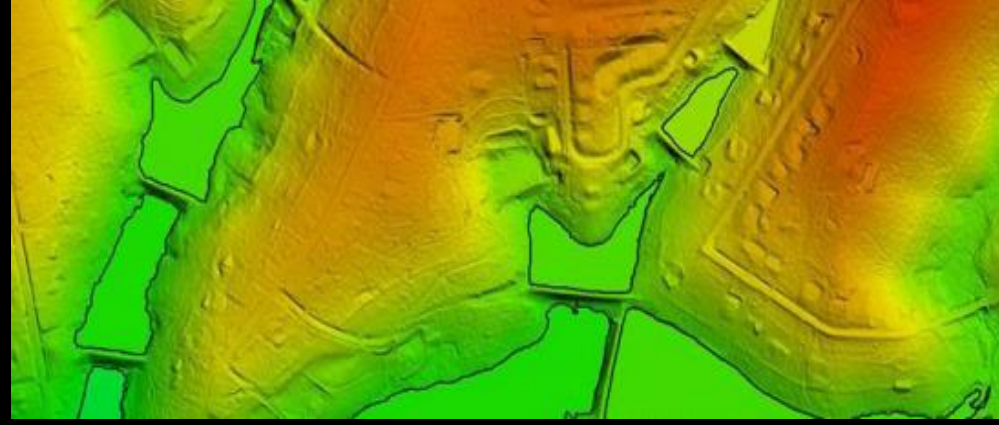
DEM Products

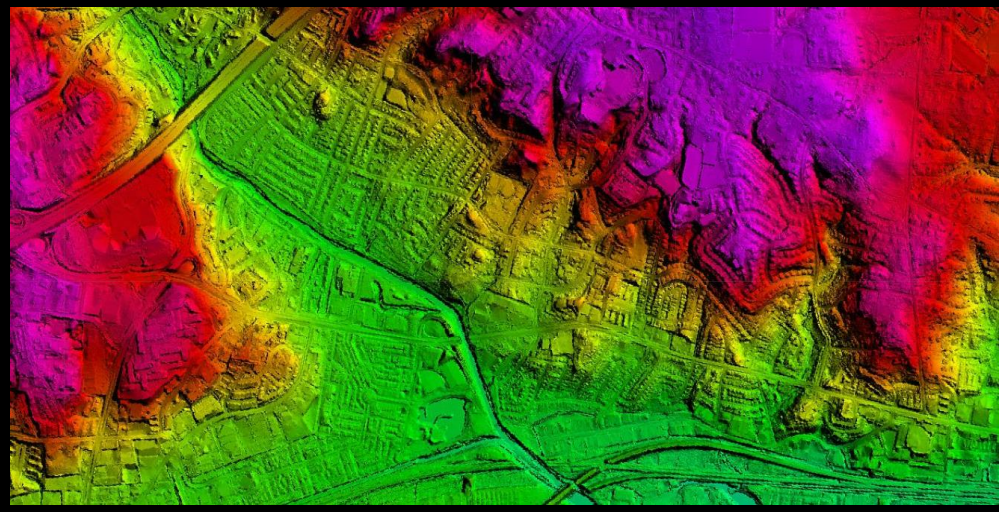
Breaklines

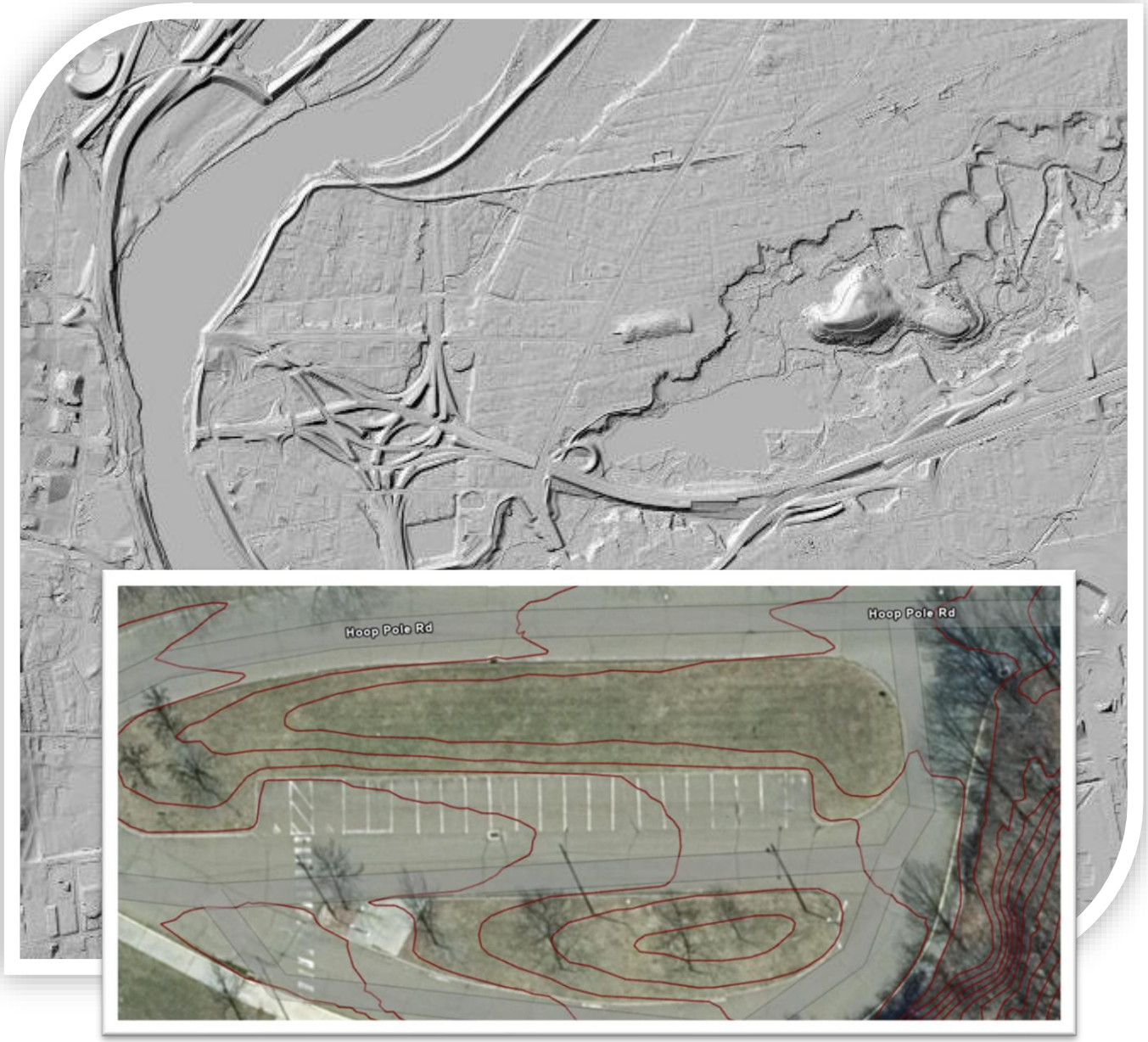
- ML/AI training and extraction of hydrographic features
- Manual review of 2D placement and completeness of capture
- Hydrographic features are conflated, enforce monotonicity for Rivers
- 3D QC is performed (Vertical Variance, Monotonicity, Topology)
- Bridge breaklines are collected where necessary, to flatten bridge saddles

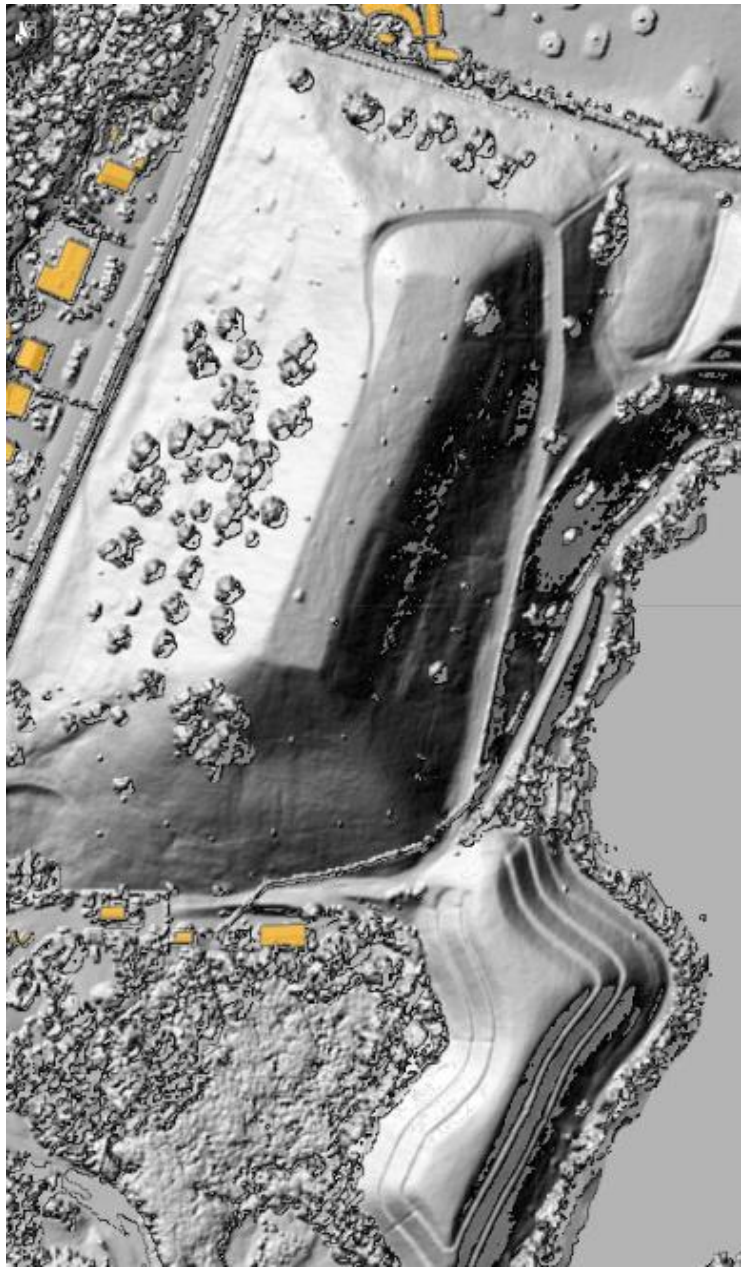
Bare Earth DEM Generation

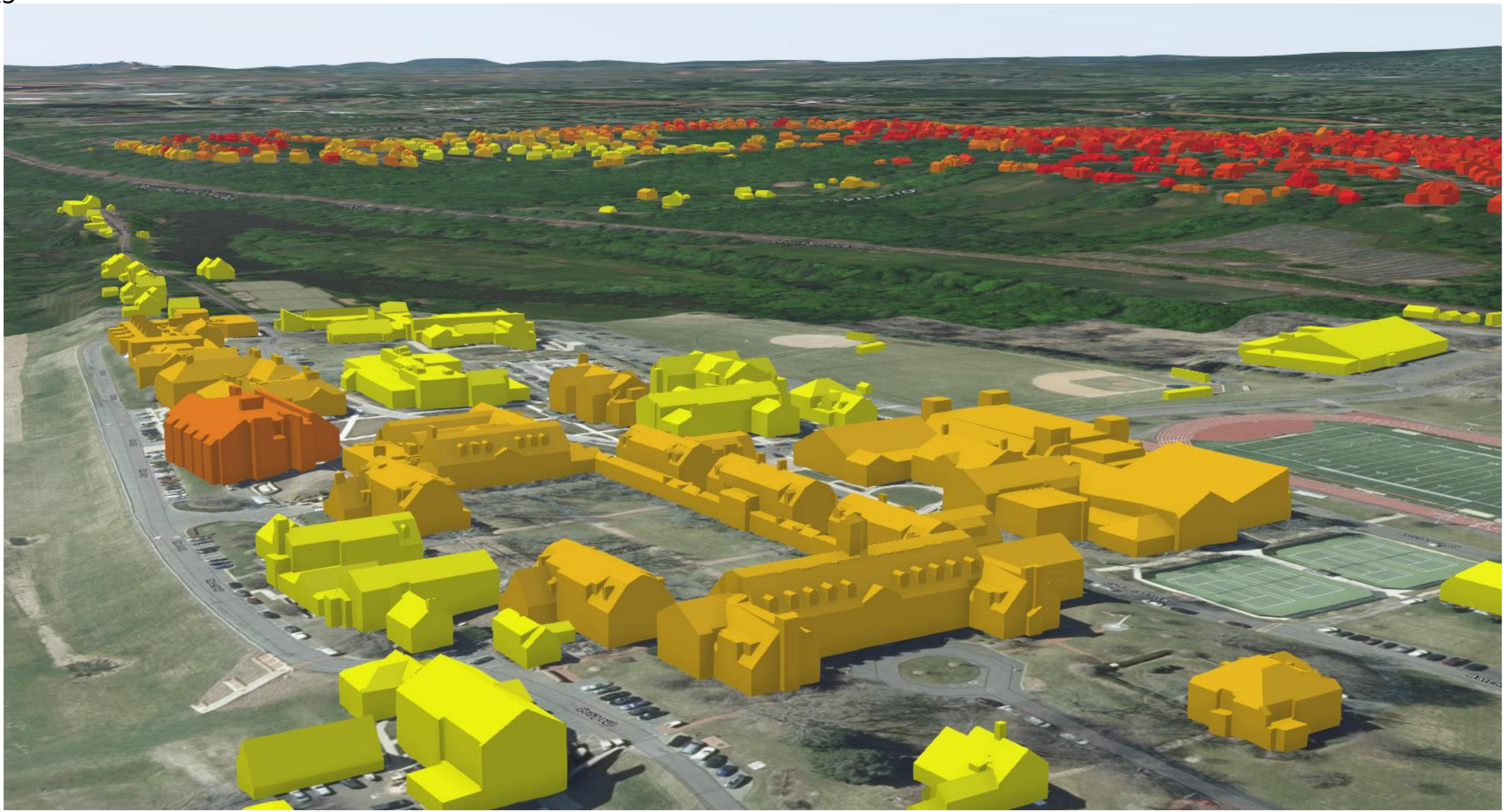
- Initial Bare Earth DEMs generated and reviewed, with QC focus on bare earth definition and hydro-flattened features
- Final Bare Earth DEM accuracy tested (NVA and VVA)
- All final products generated in required formats






Hoop Pole Rd
Hoop Pole Rd





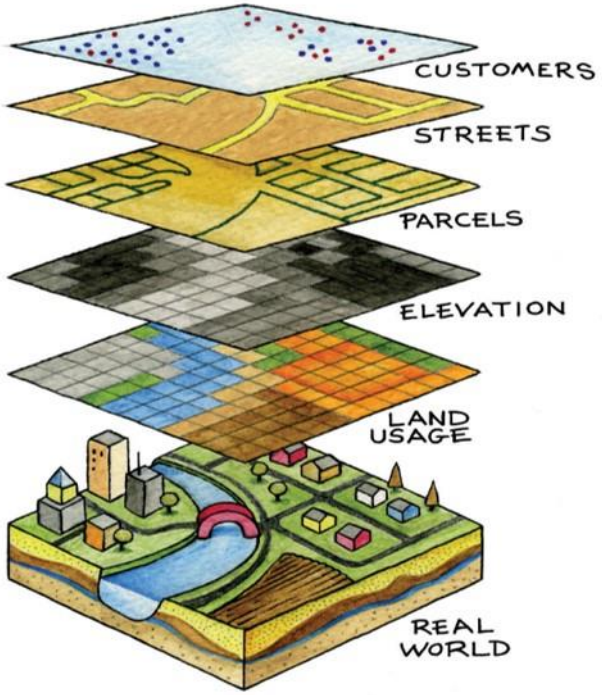
Data volume: How do we deliver this data to you?

The data is really BIG.

- 23k tiles over 4 blocks
- RGB and NIR (3”)
  - 23k Imagery Tiles and 2.338 trillion pixels
  - 2 data sets & 7 bands
- Classified Lidar
  - 177 billion lidar points with 10+ classes
- DEM (raster, 2 ft)
  - 36.5 million elevation pixels
- Buildings
  - 1.9 million buildings
- Streams, rivers, coastline
  - 1000 +/- miles
- Ponds
  - 3700 ponds and lakes

Different Geospatial Approaches

GIS Desktop Model

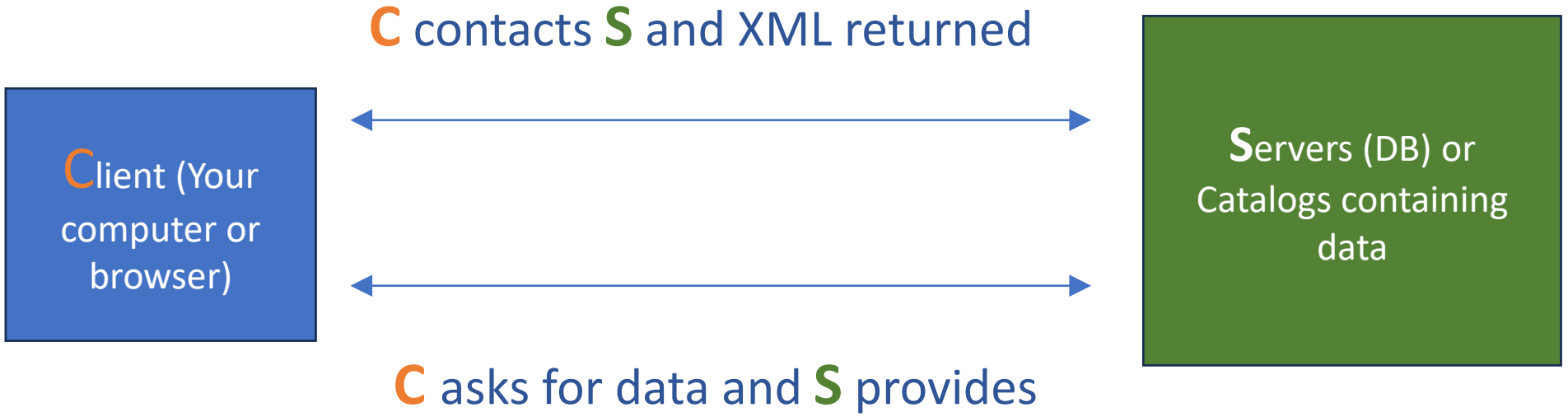


https://dev.solita.fi/2018/01/05/gis-services.html

Web GIS Model

https://sspinnovations.com/blog/web-gis-service-oriented-architecture-accelerating-change/

Basic Web Services Model: Client /Server



Web services work on a network and allow data to be exchanged. They use standards (OGC) to maximize interoperability.

Data & Policy Analytics

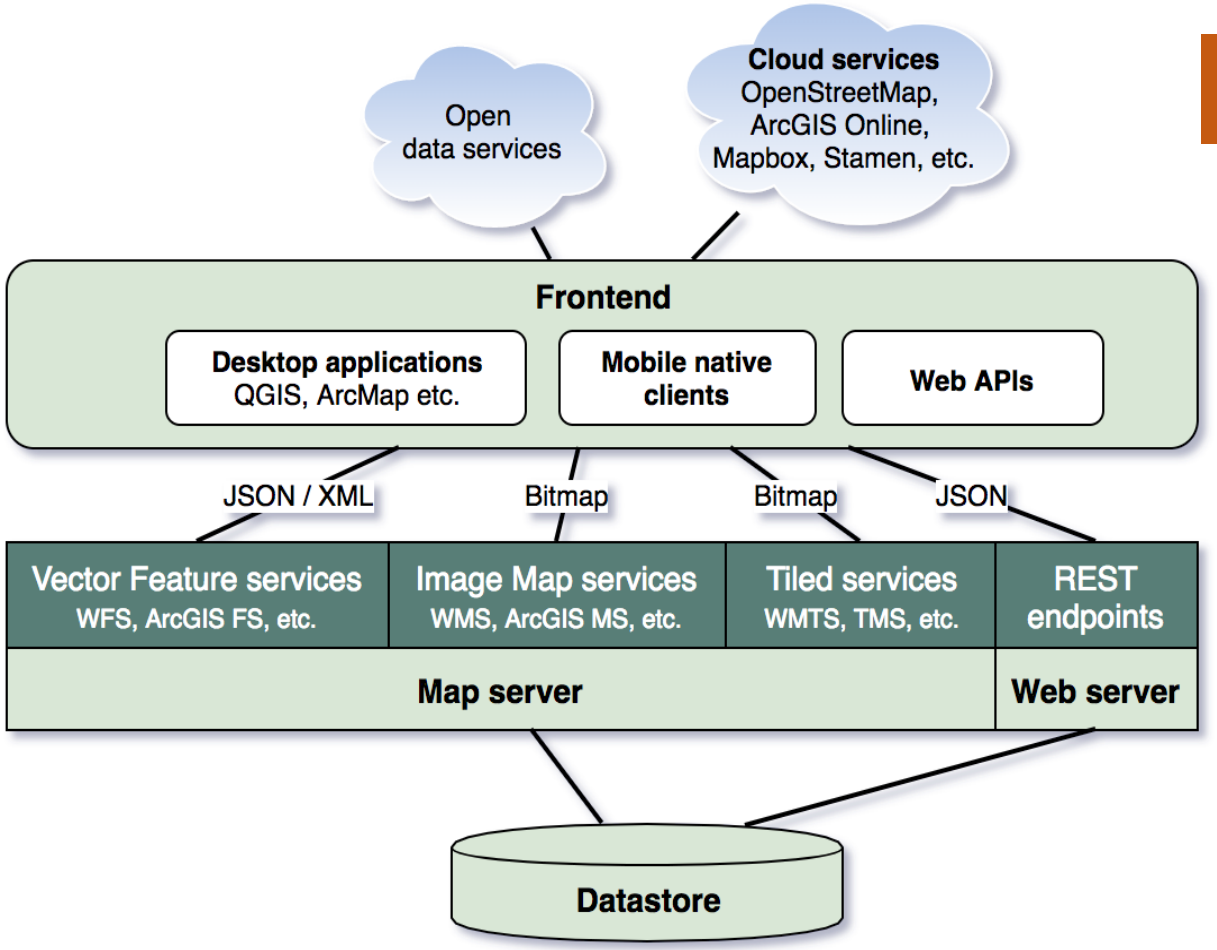
What are Web Mapping Services?

- It is a simple web interface for requesting geo-registered map images from a GIS.
- Typically, a data set and area of interest are part of the request
- Geospatial data is returned.
- 2 camps
  - OGC and ESRI

https://support.esri.com/en-us/knowledge-base/faq-what-is-the-difference-between-a-map-service-featur-000027304

https://www.ogc.org/standard/wms/

Web Services Architecture



Consumer / Client

Processing

Storage/ Server

GIS4 Schools. Introduction to Geospatial Web Services. Found at: https://gis4schools.readthedocs.io/en/latest/part2/2_1.html#:~:text=WCS%20%2D%20Web%20Coverage%20Service%2C%20which,requests%20information%20about%20the%20coverage.

https://dev.solita.fi/2018/01/05/gis-services.html

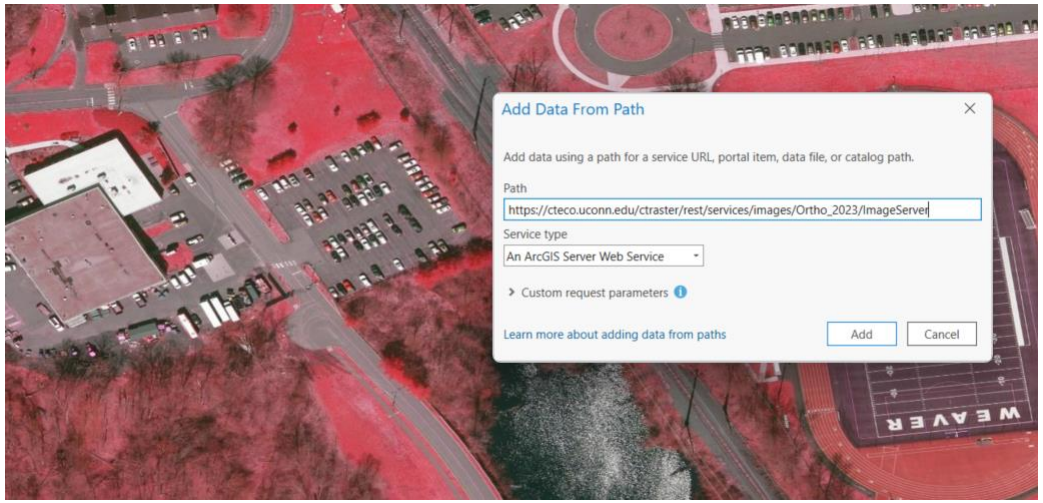
What are the Basic Geospatial Web Service Types?

- Basic types
  - Image-based map services
  - Feature-based services
  - Tile Map services

GIS4 Schools. Introduction to Geospatial Web Services. Found at: https://gis4schools.readthedocs.io/en/latest/part2/2_1.html#:~:text=WCS%20%2D%20Web%20Coverage%20Service%2C%20which,requests%20information%20about%20the%20coverage.

Image Services

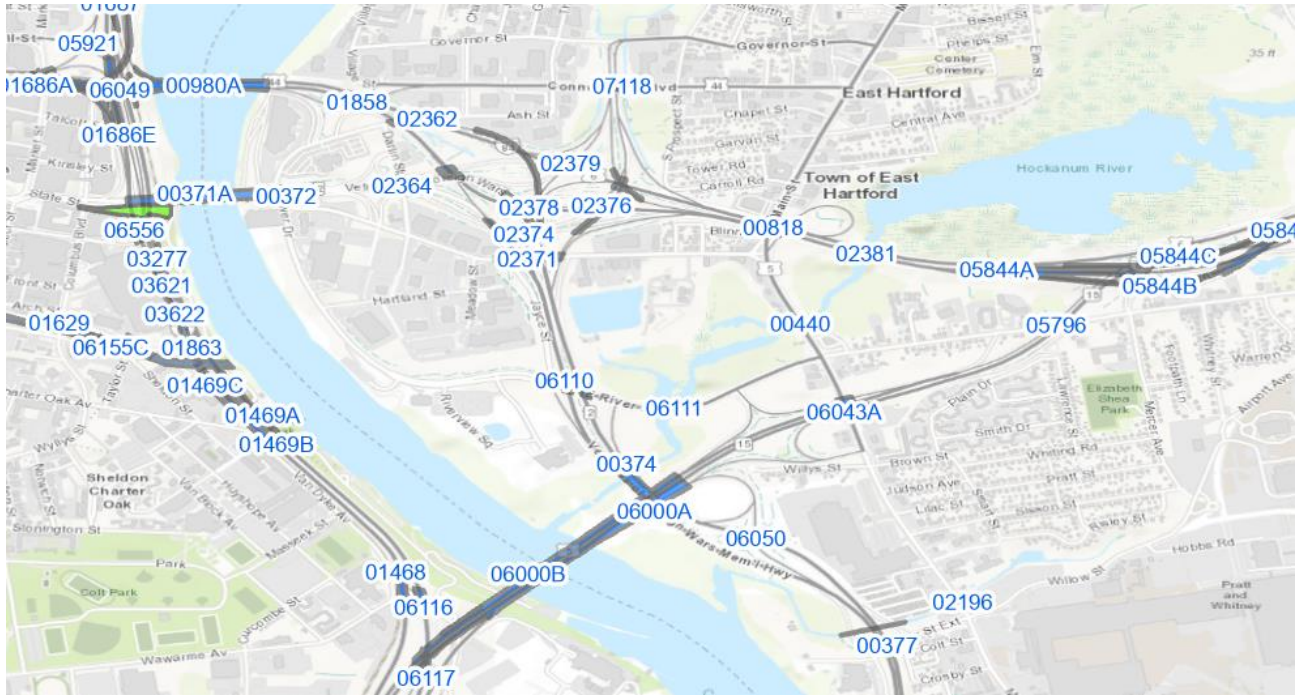
- Map services
  - WMS (OGS)
  - MapServices (ESRI Server)
    - Dynamic
- Use image formats to transfer data
- Visualization done by client
- RGB/NIR, Elevation



https://www.marsbim.com/how-geospatial-engineering-services-drive-smarter-cities/

Feature-based services

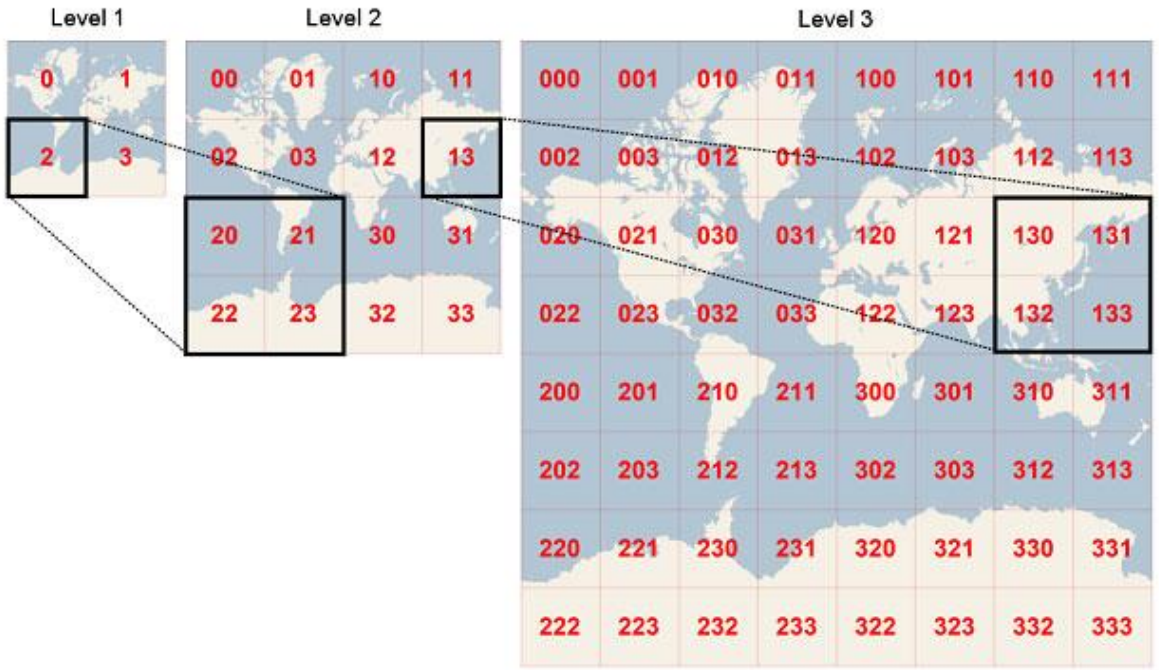
- Vector
  - WFS (OGS)
  - Feature service (ESRI)
- Geometric objects and control
- Visualization done by client
- Point, line, polygon data.
  - Transportation data uses these formats extensively



Service from CT DOT Open Data Portal

Tiled Map Services (aka. cached)

- Consists of map tiles in a cache
  - Typically 256x256 pixels
- Uses “Zoom” levels from low (level 1) to high (level 22)
- Handles large amounts of data like imagery
- Very fast and scalable because “pre-cached”
- Also vector tiles

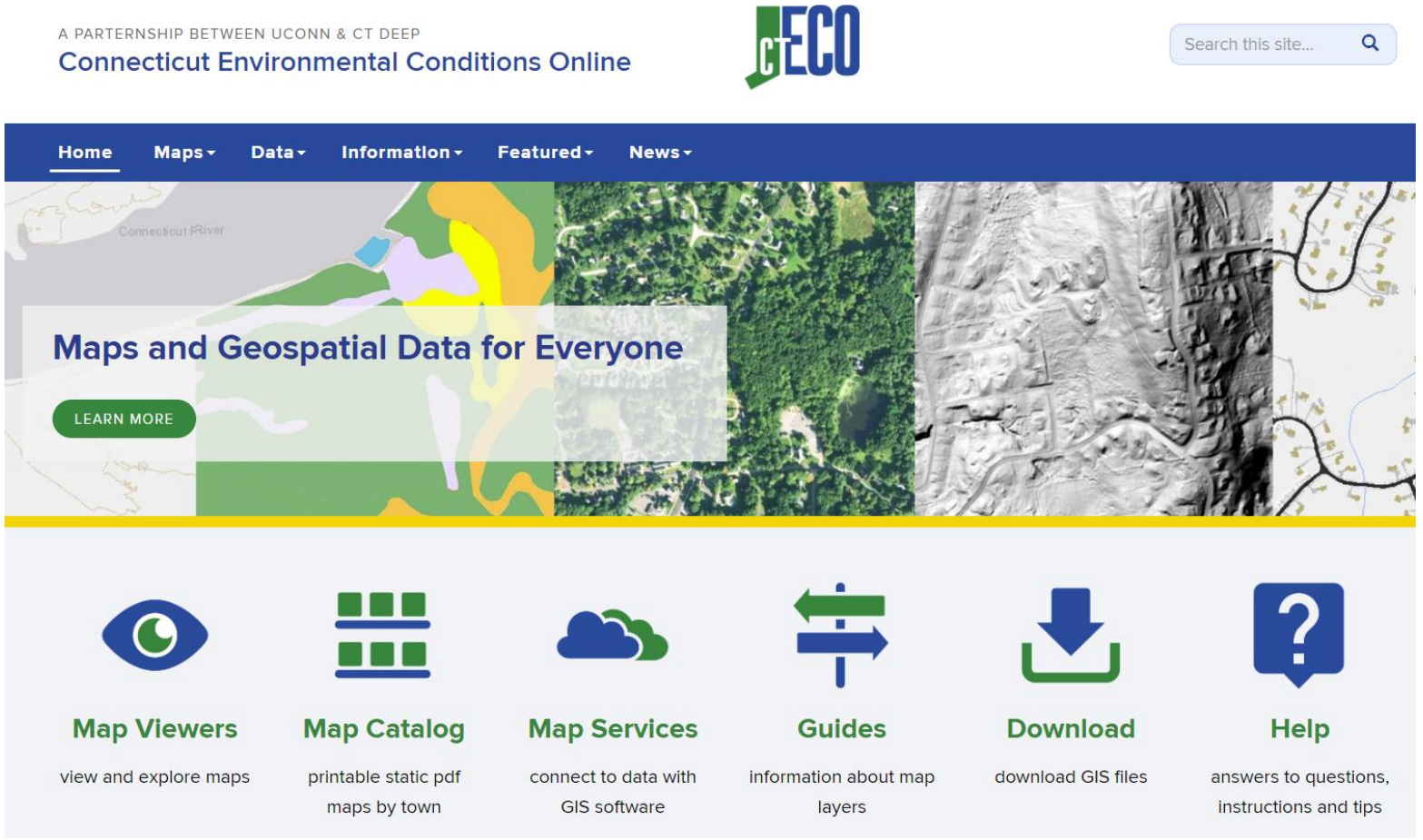


https://nextbillion.ai/glossary/what-is-a-map-tile

https://dev.solita.fi/2018/01/05/gis-services.html

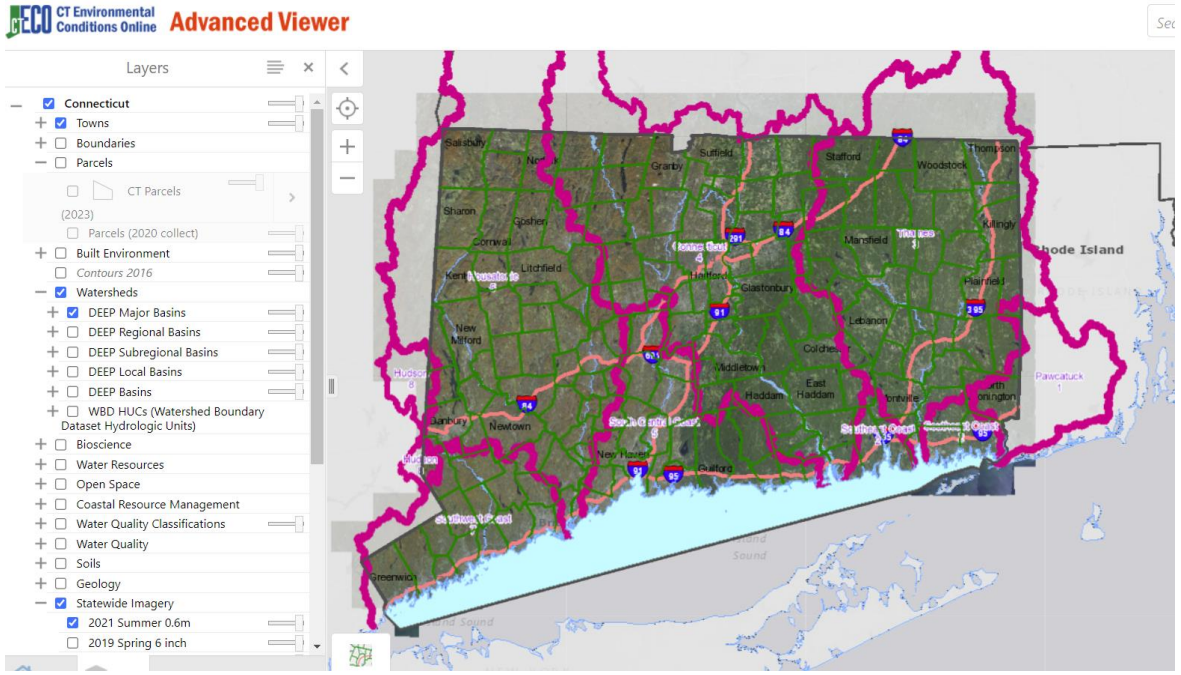
Where to Find Services?

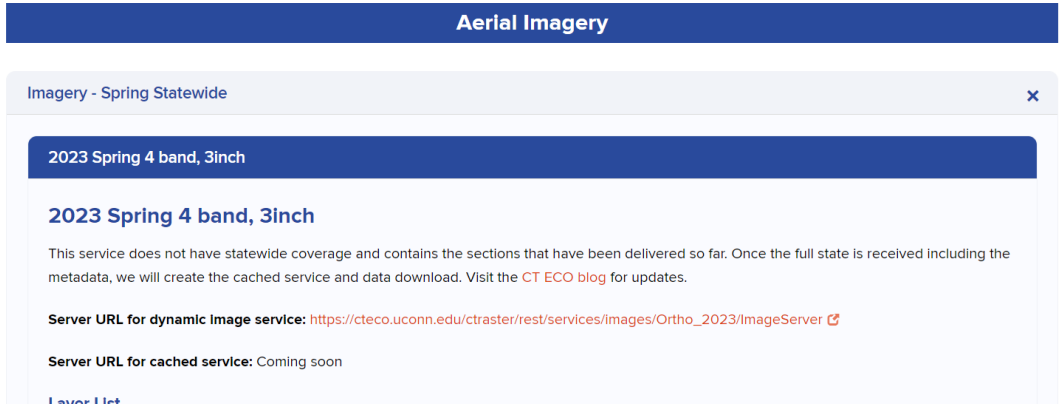
- CT ECO
  - Emily Wilson
- Methods
  - Viewers
  - **Services**
  - Downloads

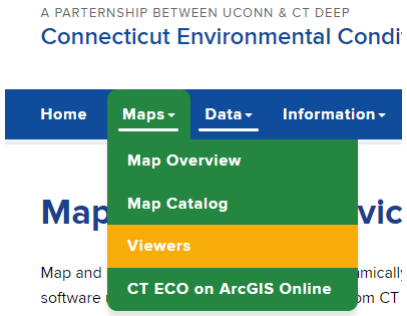


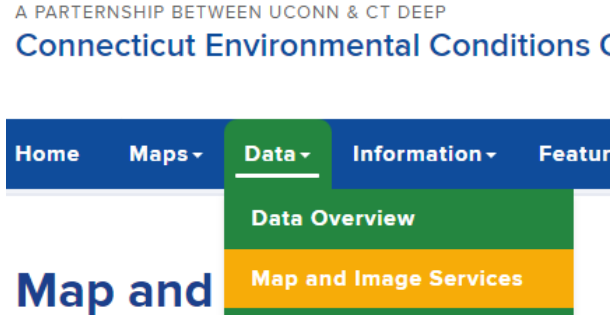
Found at: https://maps.cteco.uconn.edu/

Viewer v. Services v. Downloads (Demo)









How to Consume the Imagery Services?

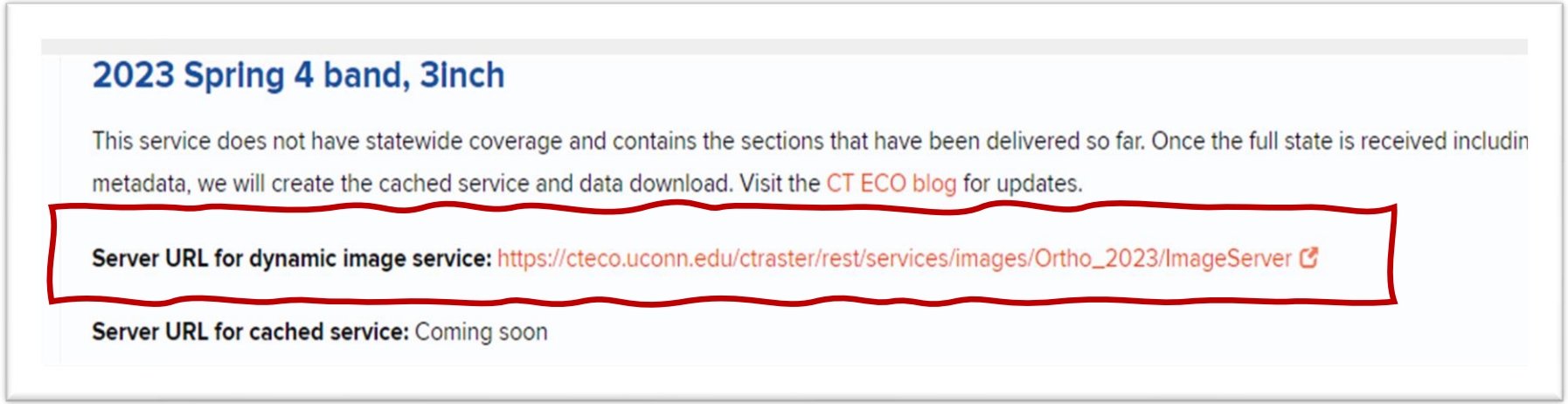
Options for Viewing Imagery Service

- ESRI products and others
  - ArcGIS Online
  - ArcGIS Pro Desktop
  - Imagery Viewer Instant App/Experience Builder
- AutoCAD and MicroStation
  - ESRI plug-in
  - WMS
- QGIS *(free)*
  - Open-source desktop
  - Both WMS and Image Services
- Leaflet and R/Python *(free)*
  - Light scripting (10-15 lines of code)
  - WMS format or need ESRI plug in

Limited free options to view web services

Viewing in AGOL

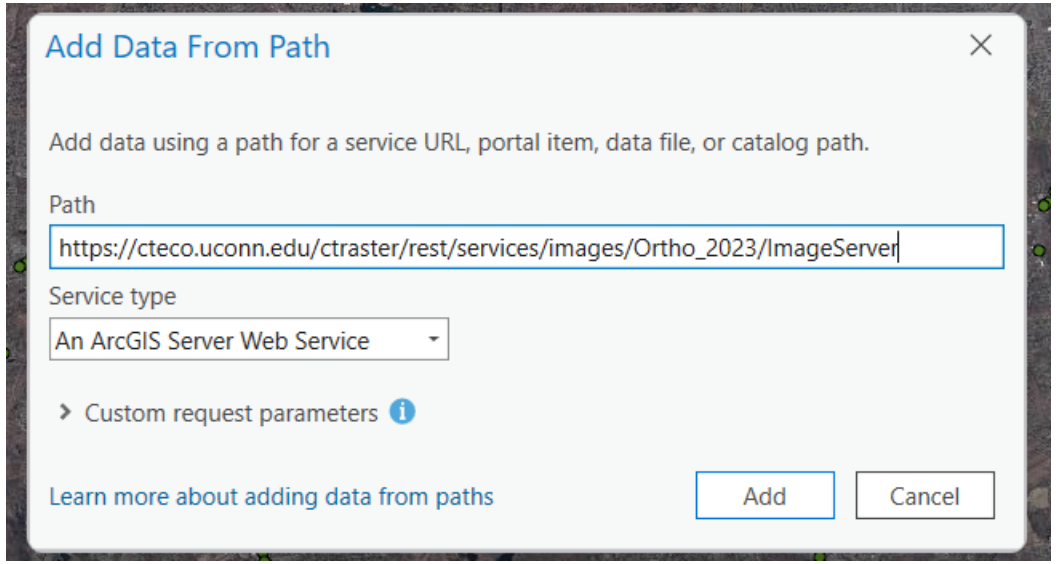
- **AGOL**
- Use the Map tab to open the Map Viewer
- Hit Add, have url ready
- Extensive instructions are available on CT ECO



https://maps.cteco.uconn.edu/help/connect_agol/

Viewing in ArcGIS Pro

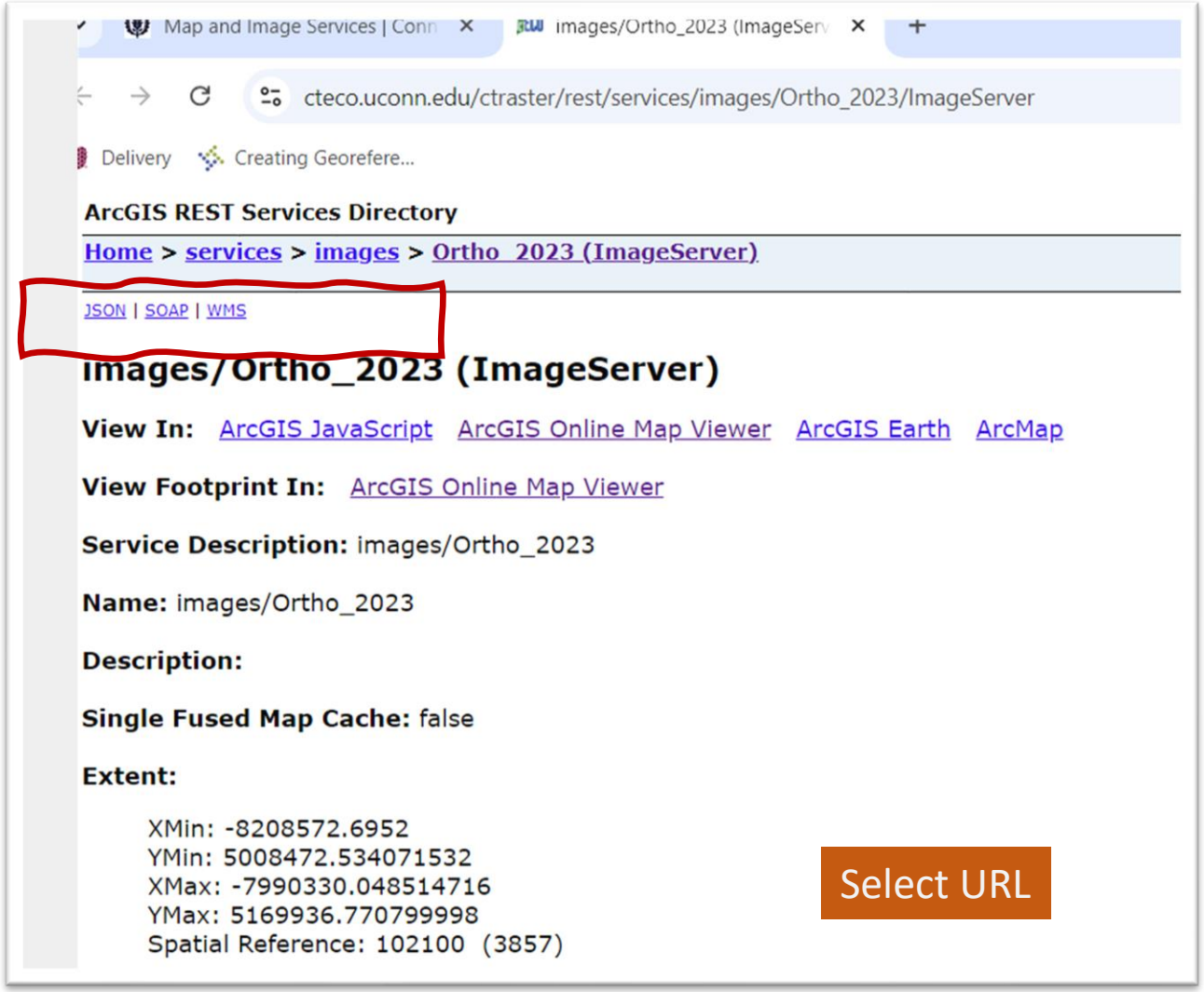
- Map tab>Add data>Add data from path
- Select service type and add



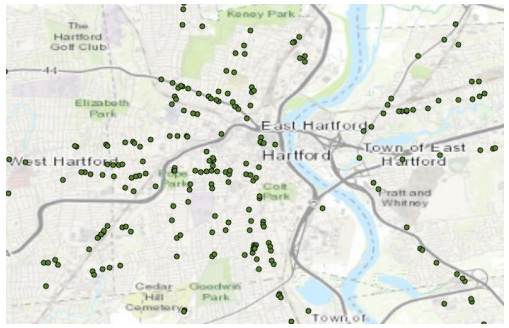
https://maps.cteco.uconn.edu/help/connect_agol/

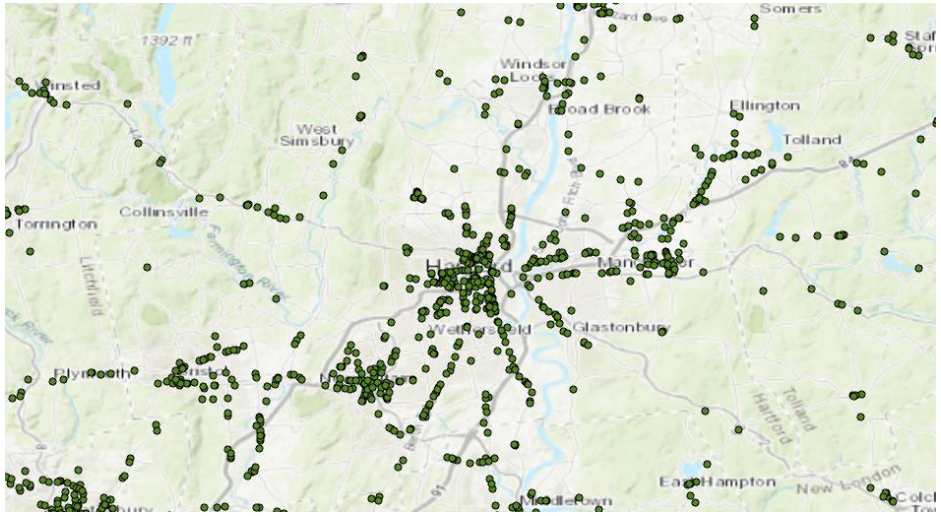
ArcGIS Rest Services Directory

- From ArcGIS server
- Includes underlying metadata and additional services
- **WMS** url available for open-source tools and CAD packages
- Example:
  - `https://cteco.uconn.edu/ctraster/services/images/Ortho_2023/ImageServer/`**`WMS Server`**



Before and After

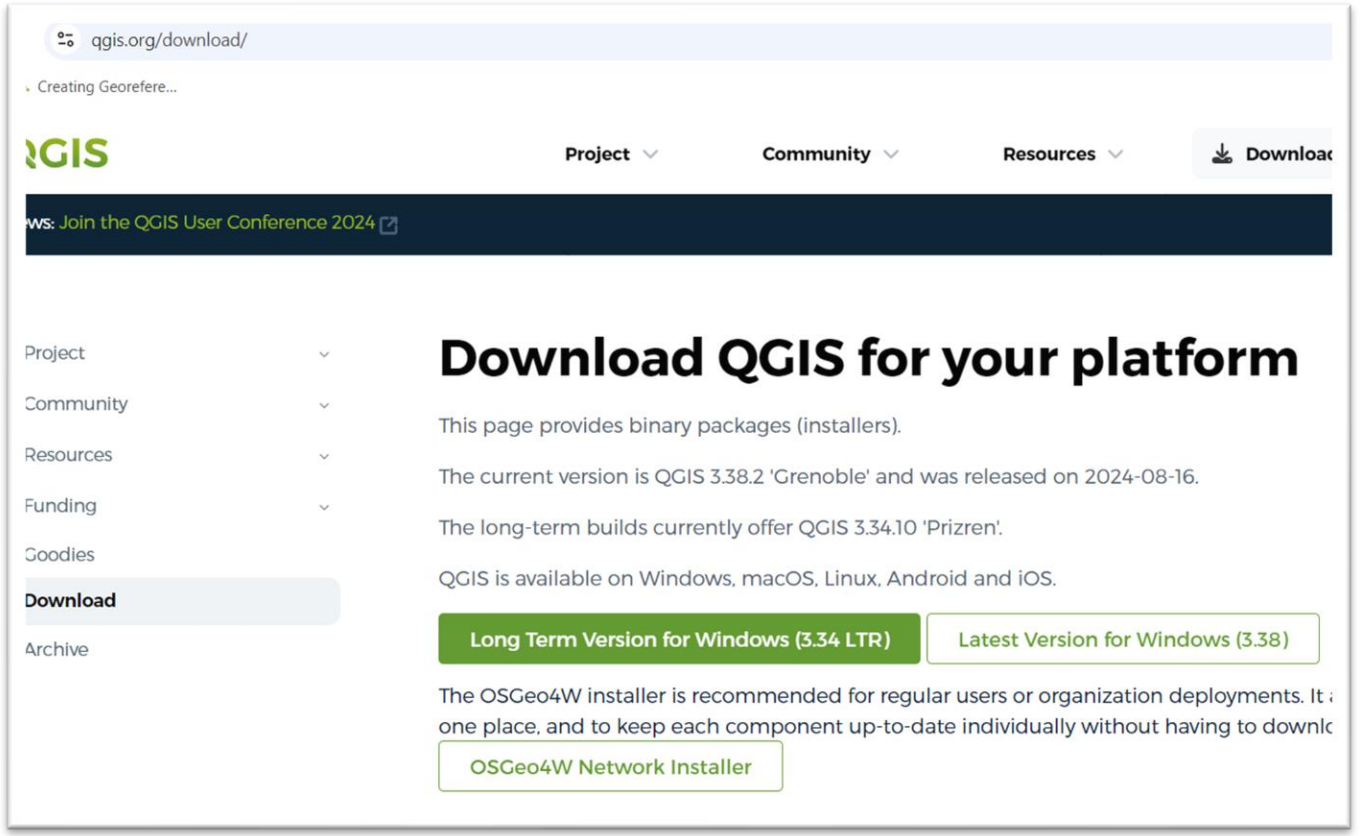




https://maps.cteco.uconn.edu/help/connect_agol/

QGIS and OGC Services

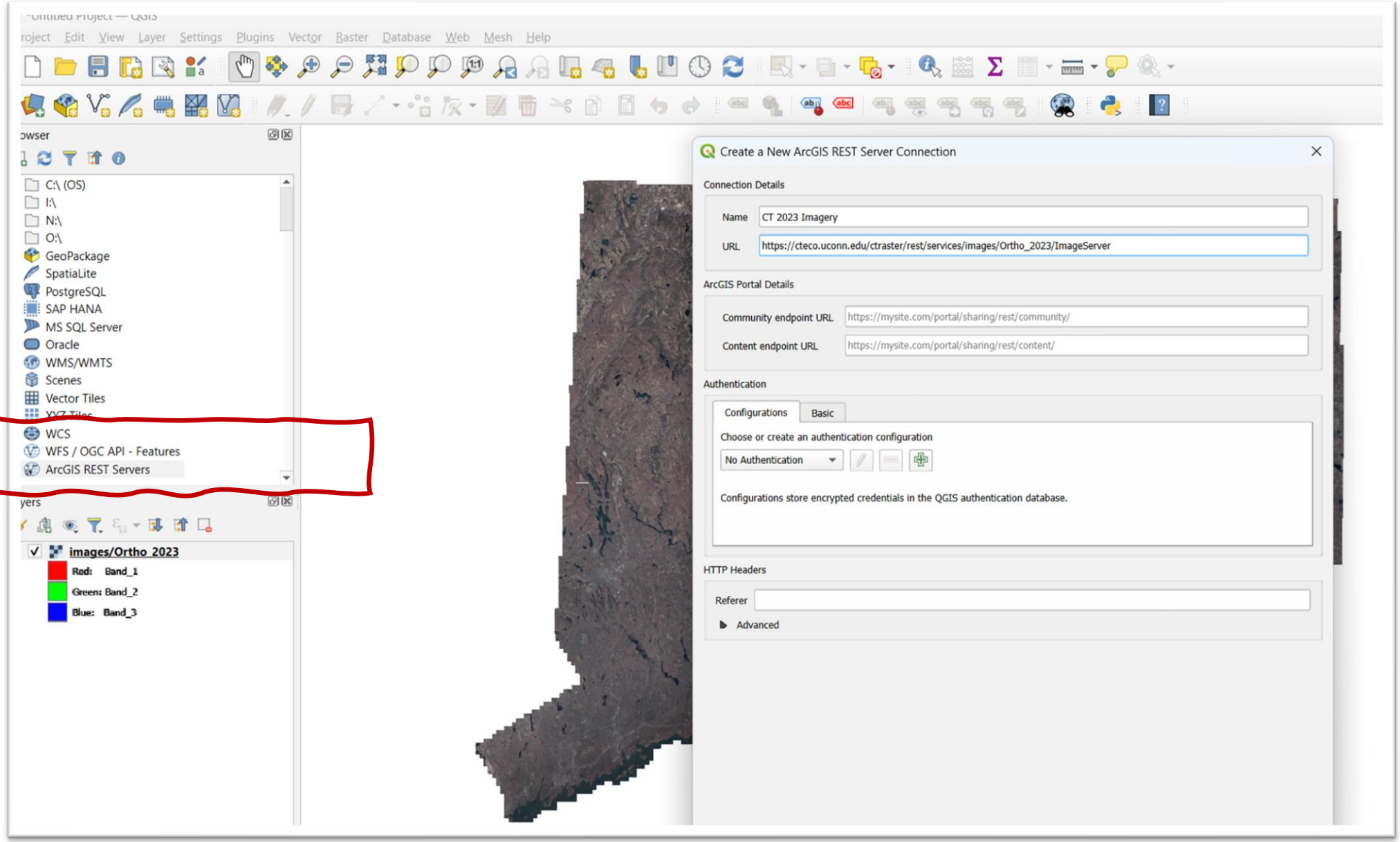
- Download stable enterprise version of QGIS



https://www.qgis.org/download/

QGIS

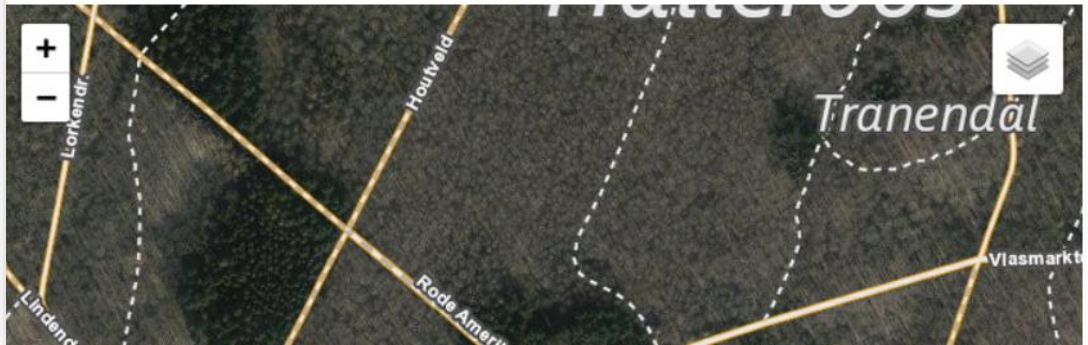
- Rt click ArcGIS Rest Servers in Browser panel
- Add URL
- Select layer panel



R and Leaflet – viewing WMS services

- Can get WMS url from Rest Services Directory
- Small amount of R code will load up image service
- Use “addWMSTiles()” command

```
leaflet() %>%
  setView(lng = 4.287638, lat = 50.703039, zoom = 16) %>%
  addWMSTiles(
    wms_ortho_be,
    layers = "orthoimage_coverage",
    group = "Orthophoto BE") %>%
  addWMSTiles(
    wms_cartoweb_be,
    layers = "overlay",
    options = WMSTileOptions(format = "image/png", transparent = TRUE),
    group = "Topo BE"
  ) %>%
  addLayersControl(
    baseGroups = "Orthophoto BE",
    overlayGroups = "Topo BE"
  )
```

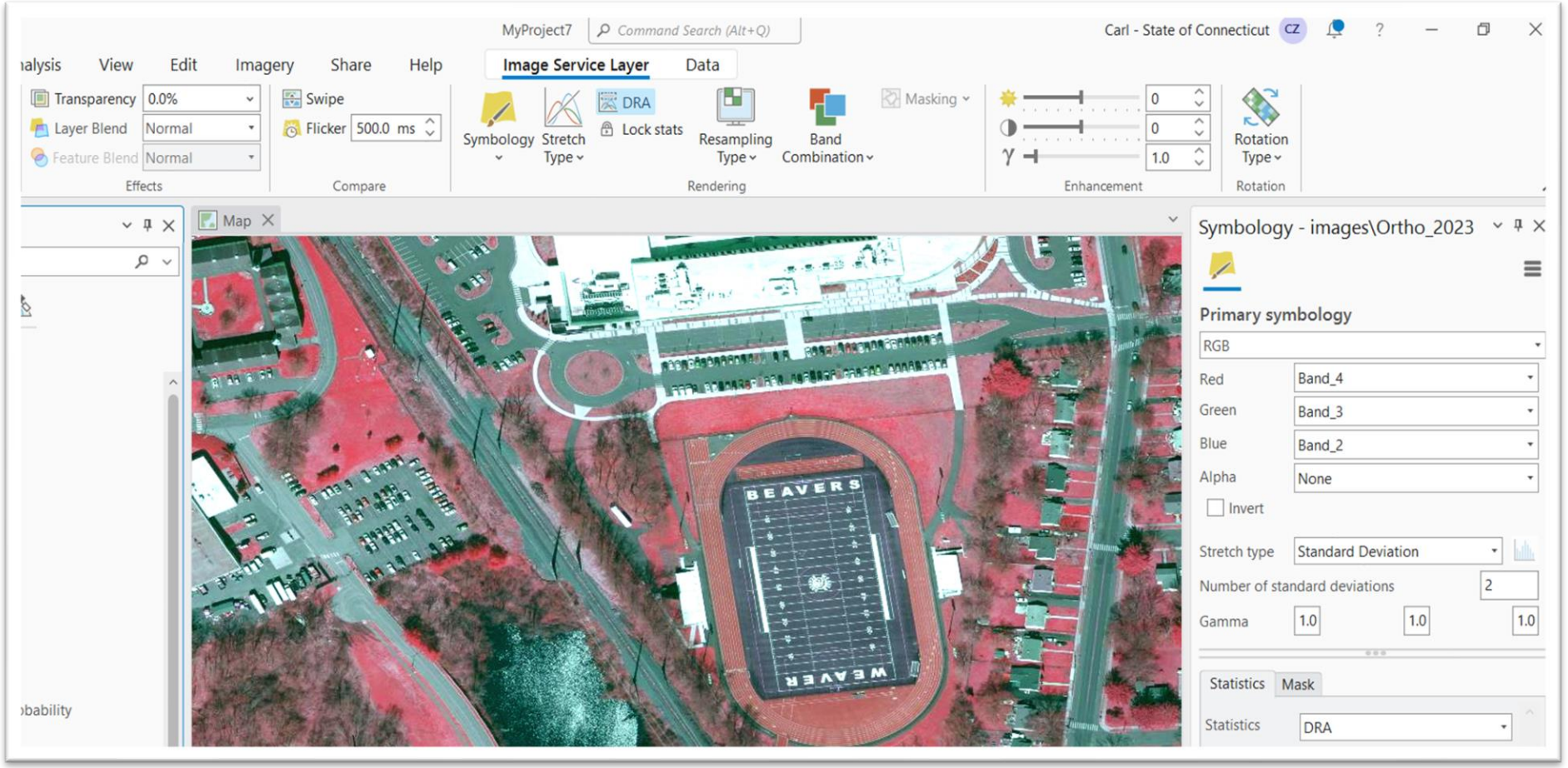


https://inbo.github.io/tutorials/tutorials/spatial_wms_services/

What can we do with image services?

Imagery Service Layer Tab(Pro)

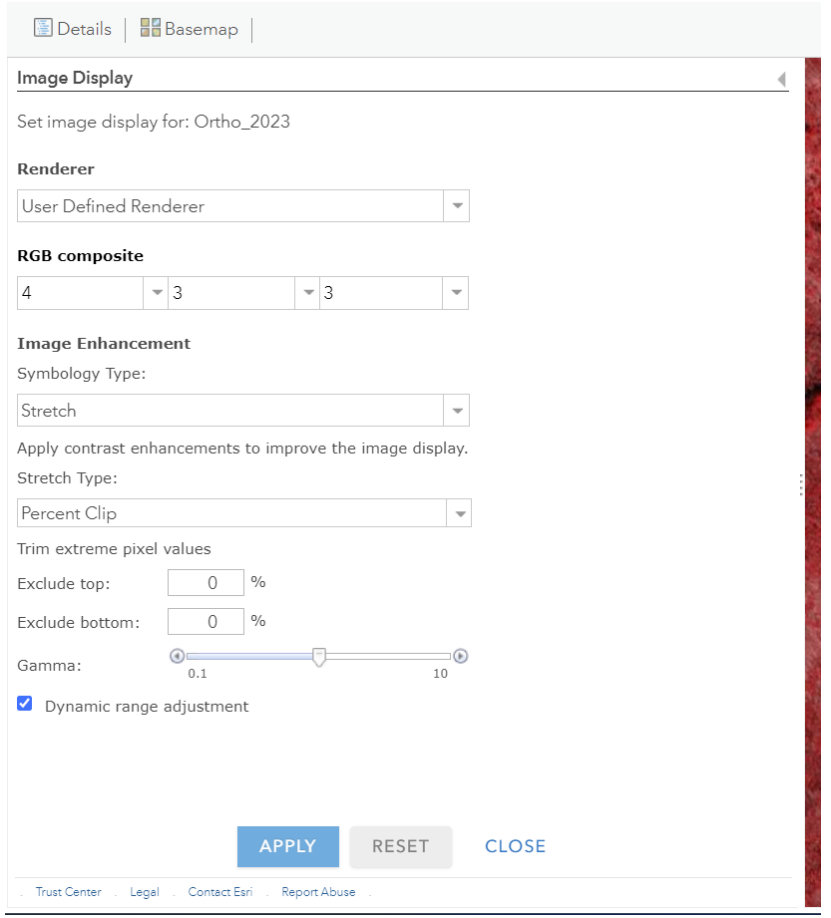
- Use imagery services layer
- DRA-local adjustment
- Stretches
- Band combos



https://pro.arcgis.com/en/pro-app/latest/help/data/imagery/raster-display-ribbon.htm

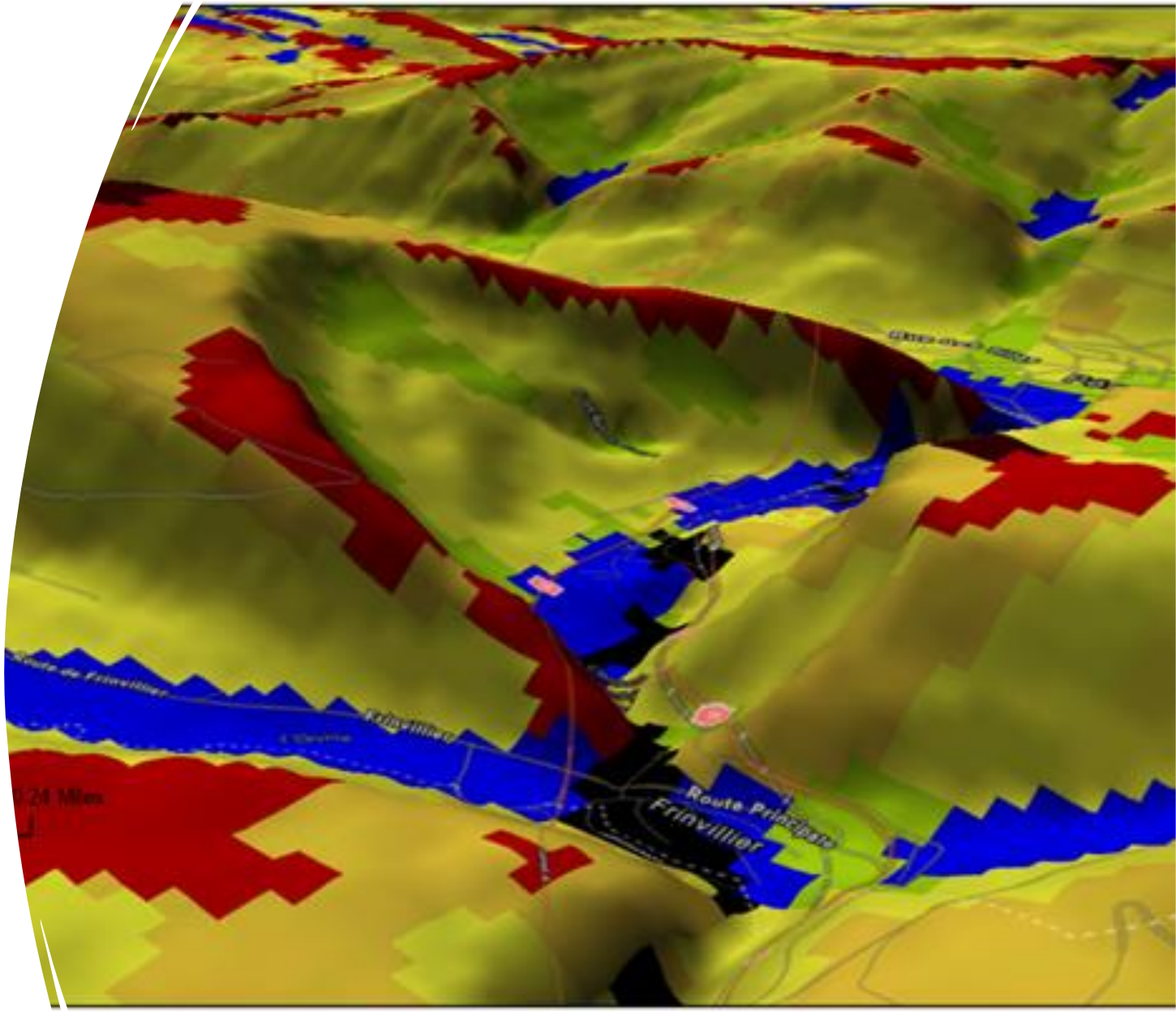
Display Options in AGOL Map Viewer

- Similar functionality for image adjustment is available in Map Viewer
- Using image display allows for different patterns to be revealed within imagery



Elevation data

- A variety of downstream analyses are available
  - Hillshade and orientation tools
  - Hydro tools
  - Geomorphological and land scape tools
    - Whitebox tools



https://community.esri.com/t5/arcgis-spatial-analyst-blog/classify-terrain-with-the-new-geomorphon-landforms/ba-p/1271214

t, Source: Airbus,USGS,NGA,NASA,CGIAR,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User butors, FOEN / Swiss Parks Network, swisstopo, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc,

DEMOs

- ArcGIS Pro and ImageService
- QGIS and ImageService or WMS

Data & Policy Analytics

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Questions????

alfredo.herrera@ct.gov
carl.zimmerman@ct.gov
emily.wilson@uconn.edu